Mass. The veteran Professor Tuckerman, of Amherst, still remains, and from him and Professor Lesquereux, of Columbus, Ohio, the well-known palæontologist, we now hope to obtain a work on mosses to supply the place of the old manual and to bring the science up to date.

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EMOTIONAL EXPRESSION.

BY A. T. BRUCE.

TO Darwin, more than to any previous investigator, must be credited precise and comprehensive explanations of emotional expression, owing largely to the prominence given by him to hereditary influences which often afford explanations of emotional phenomena where individual experiences do not appear sufficient. The study of emotional language is interesting both from a physiological and psychological point of view. Considering its psychological bearings it seems proper, before entering on a detailed description of any emotional expression, to present in outline such a definition and classification of emotions as narrow limits admit of.

An emotion may be defined as a tendency to act accompanied or unaccompanied by a particular feeling. In the common acceptation of the term, emotion means a tendency to act accompanied by a feeling which is the distinctive mark of the emotion. Tendencies to act in ways more or less definite on the application of proper stimuli, when no feeling is present in the sensorium, are respectively known as reflex or automatic actions, the stimuli being external in the former case and internal in the latter case.

The two kinds of emotive tendencies mentioned are separated by no well defined boundary. Emotions accompanied by feeling, when oft repeated, tend to become automatic, while emotions ordinarily unaccompanied by feeling may, in the absence of higher emotions, send impressions to the sensorium.

Instincts comprise a class of emotions, connecting emotions accompanied by feeling with those unaccompanied by feeling.

Confining our attention to what is commonly known as an emotion, it is apparent that the feeling accompanying each is pleasurable or painful. When the feeling is pleasurable the tendency is to continue the course of action entered upon; on the other hand, when the feeling is painful, the tendency is to desist

from the course of action which has as its concomitant the painful feeling. Pleasurable emotions might be defined as attractive and painful emotions, as repulsive inclinations or tendencies. Objects which by their stimuli bring about attractive or repulsive tendencies, are pleasurable or painful. It is needless to say that the pleasurable or painful elements are frequently so combined in an emotion, that it is difficult to determine whether the compound is pleasurable or painful. Looking at the physiological concomitants of these two broad classes of emotions, evidence seems to sanction the view that pleasurable emotions are accompanied by well-sustained, while painful emotions are accompanied by ill-sustained, nervous actions. Physiologically viewed, a pleasurable emotion is a nervous action wherein the nervous energy does not sink below a certain level, the repairs afforded by nutritive substances keeping it above that level. The physiological aspect of pain is waste exceeding repair, the nervous energy thus sinking below a certain level.

Ignoring feeling altogether, it must follow that a creature with no hereditary paths of action already cut in its nervous mechanism would act mainly in lines where its movements were well sustained. Such movements would, in the long run, come to have a preponderance over ill-sustained or painful movements. Moreover, movements from a source of pain being better sustained than movements towards that source would eventually prevail. Consequently the repulsive nature of pain is a physiological consequence. Feelings accompanying attractive and repulsive tendencies are by association pleasurable or painful. If these conclusions be granted, we have an explanation of the emotions and of that totality of emotional influence which constitutes will, as Professor Bain has pointed out.

Now the actions of every individual under an emotional stimulus of any nature, are determined not only by his own experiences, but by a vast experience of pains and pleasures bequeathed to him by his ancestors. Accordingly in studying the actions which are the objective expressions of various emotions, it is necessary to consider the ancestral as well as the individual experience which has made the particular expression what it is. The antithesis of painful and pleasurable emotions is Darwin's limited "principle of antithesis" extended so as to include all emotional expression. Speaking broadly the expression of pain-

ful emotions is a relaxed state of the muscles while pleasurable emotions are expressed by a vigorous action of the muscles. This general statement needs modification in some cases where, as often happens, pleasurable and painful emotions are combined, or where the emotion, though painful, is expressioned by movements from the source of pain, such movements, as before stated, being better sustained than movements in the opposite direction. Granting this fact, it must still be admitted that pain, *per se*, often is a strong stimulus in provoking muscular contraction. The writhings of one in pain are not simply movements from a source of pain. Yet even in such cases the action is not long continued, and is apt to exhaust itself sooner than actions expressive of pleasure. Moreover such actions, under painful stimuli, are in a certain sense movements from a source of pain, for the contraction of the muscles, by bringing about vascular dilation, draws the blood from the over excited nerve centers; consequently the excessive nervous action is lessened by their contraction. A proper understanding of what has already been said concerning emotions in general will be of assistance in the study of particular emotional phases which it is the writer's purpose very briefly to discuss. The study of the whole field of emotional expression, at once precise and philosophic, attempted by Darwin, is fully appreciated by naturalists. There remains, however, many points of interest connected with emotional expression, where an extension of Darwin's views is possible. In his "Expression of the emotions" Darwin appears to have based his order of presentation on no classification of the emotions, moreover he occasionally presents his "principle of antithesis" as an explanation of emotional expression where the actions might be better explained on the universal principle of pleasure sought or pain avoided. For instance, the shrugging of the shoulders as indicative of helplessness is explained by Darwin, on his principle of antithesis, as being the contrary of emotions expressive of effort or determination. It would appear more philosophic to ascribe such acts to incipient *cringing* or cowering. Helplessness implies an obstacle which cannot be resisted or overcome. Now it must be obvious that when a creature meets an adversary too powerful to be resisted or avoided, the only course to pursue is to lessen the pain of chastisement which the powerful adversary may inflict. If its adversary be a bully of its own species, capable of being pacified by propitiatory movements, the movements of the weaker creature serve a dou-

ble purpose. The actions of the creature are necessitated by the universal law of movement in paths of pleasure.

The movements in the case under consideration would be the protection of the softer and more sensitive portions of the body by the harder and more callous parts. Accordingly the viscera are protected by leaning forwards, by bringing the elbows to the side and by spreading out the hands. The head is at the same time depressed, presenting the less sensitive portions instead of the more sensitive face, while the shoulders are elevated so as to cover the more sensitive neck. Putting all these movements together, we have the expression of abject helplessness denominated cringing. But when for an aggressive and unavoidable adversary, we substitute an insuperable obstacle, we notice the same element of helplessness without the obvious need of self-protection. There are, however, similar elements in both cases. Consequently by "substitution of similars," a process almost as general in association as in reasoning proper, we have that likeness of expression which a helpless shrug of the shoulders indicates. The truth or falsity of this explanation of the impotent shrug does not affect the general law of emotional expression or lessen the necessity of reducing all particular expressions to various phases of the same law. Taking the simpler emotions, of which the distinctive expressions have been explained by Darwin's researches, it is possible to arrange them according to their respective intensities on the scale of pleasure and pain.

Their respective positions on the scale would be somewhat as follows:

- *Pleasurable*
  - Intense, expressed by
    - Bright eyes.
    - Laughter, and
    - Partially contracted muscles.
  - Less intense, including complacency, etc., expressed by incipient smiles.
- *Mixed*
  - Anger, sullenness—expressed more or less distinctly by the actions of conflict.
- *Painful*
  - Intense
    - Agony, fear, astonishment, expressed by open mouth, contracted occipito-frontalis and corrugators in some cases.
    - Grief, despair, helplessness, etc., expressed by relaxed muscles, indicating the exhaustion from flight or pain.
  - Less intense
    - Guilt, shyness, etc., characterized by self-attention, inducing blushes through the agency of the vaso-motor mechanism.

The pleasurable emotions very briefly outlined in the table do not call for much comment. The joint cause of laughter may be suggested. The nervous activity which is the concomitant of pleasurable feeling must be discharged by the motor channels. Movements in lines of least resistance would take place in the most worn channels. Such channels are obviously those connected with automatic actions, such as breathing, which are constantly open; consequently the movements of the diaphragm result. But in order to fully explain laughter the interrupted character of the expiratory blast must be explained. Now it is perfectly obvious that an element of surprise is an important factor in the production of laughter. Surprise is accompanied by a powerful inspiration and the sudden diversion of nerve currents from their previous channels. This inspiration of surprise would have to be followed by a strong expiration which, however, is modified by movements of the respiratory muscles induced by the pleasurable stimulus and by the diverted nerve currents which find their exit through the most open channels.

The composite character of the emotions classed as mixed emotions may need some explanation. Anger with men commonly results from some insult which detracts from self-esteem. The effort is then made to regain that esteem at the cost of the insulter. There is present in consciousness self-humiliated and a representation of the insulter humiliated. More generally stated, anger implies simply the effort to remove or attack any pain-inflicting agency. In that event there is present in the mind the same two elements of pain and pleasure, weakness and strength, viz., the pain inflicted and a sense of personal power able to resist the pain.

Astonishment when unmixed is, judging from its close likeness to fear, a painful emotion. To the animal in its wild state any strange creature must, in most cases, be either its prey or its destroyer, consequently there is the open-mouthed inspiration, explainable, as Darwin has shown, as the inspiration which precedes efforts to escape or attack, while the open mouth also renders respiration less noisy, thus assisting the concentration of the attention on the strange object. Astonishment seems to have been primarily derived from a disagreeable surprise resulting from the unexpected apparition of a destroyer. Shyness is probably due to this same unpleasantness associated with strangers, aggravated in the case of man by the known propensity of strangers to criticise our appearance. Hence attention is called to self, causing blushing.